

laboratory. The inability of the cultures to live is attributed to the method of preparation and not to any knavery upon the part of the commercial producers. A test conducted by the authors of this bulletin demonstrated the inability of the organism to survive to a satisfactory degree upon the cotton. Any intention of opposing the idea of treating the seed of legumes with living bacteria is distinctly disavowed.

It is exceedingly unfortunate that this method should have been given such wide publicity and launched as a commercial enterprise until the question as to its efficiency had been thoroughly tested.—F. L. STEVENS.

Streaming of protoplasm in mucors.—This phenomenon, although very striking and easily observed, has been little studied. The movement was noticed by WORONIN in 1866 in *Ascophanus pulcherrimus*. It was described with considerable detail in a number of species belonging to different genera by SCHRÖTER, writer of the latest account,⁹ in 1897, and the conclusion was drawn that the movement was dependent upon osmotic conditions. A careful study was also made by CHARLOTTE TERNETZ in 1900, using *Ascophanus carneus*, and the conclusion was reached that it was due to the local entrance or loss of water. SCHRÖTER has confirmed and somewhat extended the work of his predecessors. For his studies he used *Mucor stol.* (as he invariably writes *M. stolonifer*) and *Phycomyces nitens*. He had better apparatus than his predecessors, and was able to arrive at some conclusions with much certainty. He found that the movement was affected only very slightly by variation in the intensity of light. The action of ether, extremes of temperature, pressure, wounds, variation in amount of carbon dioxide, was similar to that of the same agents when applied to the higher plants. The streaming is found to be due to osmotic action and transpiration and therefore does not occur in a homogeneous substratum, as for instance when the fungus is wholly submerged, or in a saturated atmosphere. The streaming is not a rotation or circulation, as in the hairs of roots and stamens and in the cells of *Chara*, *Nitella*, *Vallisneria*, etc., but a backward and forward-movement, in which the protoplasm, vacuoles, and nuclei participate. Occasionally the acropetal movement is somewhat balanced by a thin peripheral layer of protoplasm without vacuoles setting up a basipetal movement. Usually the movement is toward one end of the hyphae for a longer or shorter time, then stops and starts again in the opposite direction.—J. C. ARTHUR.

Germination and radium emanations.—KÖRNICKE¹⁰ has continued his study of the effect of radium emanations on the germination of ungerminated seeds which have been exposed in both the dry and wet condition. His earlier tests were made with radium bromid contained in glass tubes. In his later study he has used a much more powerful mixture which was contained in tubes having one side of

⁹ SCHRÖTER, ALFRED, Ueber Protoplasmaströmung bei Mucorineen. * *Flora* 95: 1-30. 1905.

¹⁰ KÖRNICKE, M., Weitere Untersuchungen über die Wirkung von Röntgen- und Radiumstrahlen auf die Pflanzen. *Ber. Deutsch. Bot. Gesells.* 23: 324-332. 1905.

aluminium, through which the emanations pass more readily. In all the trials he finds that although the germination is not prevented there is a period of retarded growth in the seedling. The elongation of the root or stem may be temporary or permanent according to the duration of the exposure. In the latter case the injured organ persists indefinitely without disorganization, but further growth of the seedling occurs in the form of secondary members. In the case of *Vicia Faba* such a condition will follow an exposure of only one hour; yet an exposure of fourteen days does not prevent germination. Since the retardation of growth occurs sooner in the root than in the stem of a given seedling, the author favors the explanation offered by other investigators, who have worked on entirely different material, that organs engaged in photosynthesis are more resistant to the emanations. The author's experiments offer no conclusive evidence on this point. Organs of seedlings from seeds exposed to emanations retain geotropic sensibility as long as they are capable of growth, the two capacities being concurrent. The same is true of heliotropic sensibility. His earlier view that radium emits enough luminosity to induce heliotropism, which was questioned by MOLISCH, is maintained. Important as these results are, it seems to the reviewer that their value would be much greater if obtained under standardized conditions.—RAYMOND H. POND.

Anatomy of *Matonia*.—TANSLEY and LULHAM describe the development and mature anatomical structure of a number of specimens of *Matonia pectinata* gathered by one of them on Mount Ophir in the Malay Peninsula.¹¹ The cotyledons in this species are bilobed as in the polypodiaceous ferns. Below the first leaf the central cylinder of the young stem consists of a rod of xylem, surrounded by parenchyma alone; later phloem appears on the outside of the stele and in the center as well. Subsequently the endodermis and "ground tissue" likewise appear within the stele, which becomes typically siphonostelic. By a process of "local dilatation of the margin of the leaf gaps" an internal mass of fibrovascular tissue appears, which ultimately becomes tubular and lies within the original fibrovascular tube. This inner tubular fibrovascular bundle subsequently gives off an internal tracheary strand, which may also become tubular, so that there may be in *Matonia* as many as three tubular bundles lying one within the other. These join each other only in the region of the nodes. The authors consider the internal fibrovascular system as a storage tissue only, since it has no direct connection with the roots, which are attached to the external cylinder, as in other ferns of this type. The views as to the morphological nature of the complex fibrovascular system of the stem in this species may be regarded as "orthodox," since the conclusion is reached that it constitutes a single stele. The hypothesis that the pith is intruded cortex is accordingly rejected, since the authors are of the opinion that the only trustworthy criterion as to the morphological value of tissues is to be derived from a study of their relation to the primary meristems of the growing point.—E. C. JEFFREY.

¹¹TANSLEY, A. G., and LULHAM, Miss R. B. J., A study of the vascular system of *Matonia pectinata*. *Annals of Botany* 19:476-519. pls. 31-33. 1905.